Ordering number: EN 2012A



No. 2012A

Monolithic Linear IC

LA1267

FM/AM Tuner Electronic Tuning Type

Functions

FM: IF amp, quadrature detector, AF preamp, signal meter, tuning indicator drive output (common with stop signal, muting drive output)

AM: RF amp, MIX, OSC, (with ALC), IF amp, detector, AGC, signal meter, tuning indicator drive output (common with stop signal), IF signal output.

Features

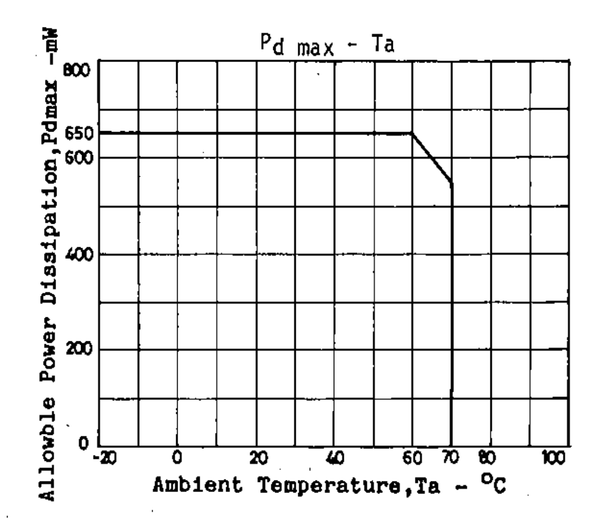
- Minimum number of external parts required.
- Excellent S/N
- Local OSC with ALC
- Local OSC buffer
- Tuning indicator pin (common with narrow-band stop signal and muting drive output)
- Variable stop sensitivity (variable separately for FM, AM)
- Low whistle
- Signal meter pin.
- Especially suited for AM stereo, IF count electronic tuning because of AM IF signal output.

Maximum Ratings at Ta=25°C, See Test Circuit.

				unit
Maximum Supply Voltage	$V_{CC}max$	Pins 7,8,19	16	V
Flow-in Current	I_8	Pin 8	20	mA
Flow-out Current	I_{22}	Pin 22	1	mA
	I_{24}	Pin 24	2	mA
Allowable Power Dissipation	Pdmax	Ta≦60°C	650	mW
Operating Temperature	Topr		-20 to +70	°C
Storage Temperature	Tstg		-40 to +125	°C

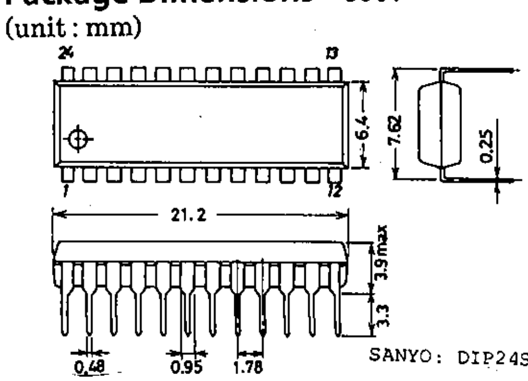
Operating Conditions at Ta=25°C

			unit
Recommended Supply Voltage	V_{CC}	8.5	V
Operating Voltage Range	V_{CC} op	6 to 14	V





(unit: mm)



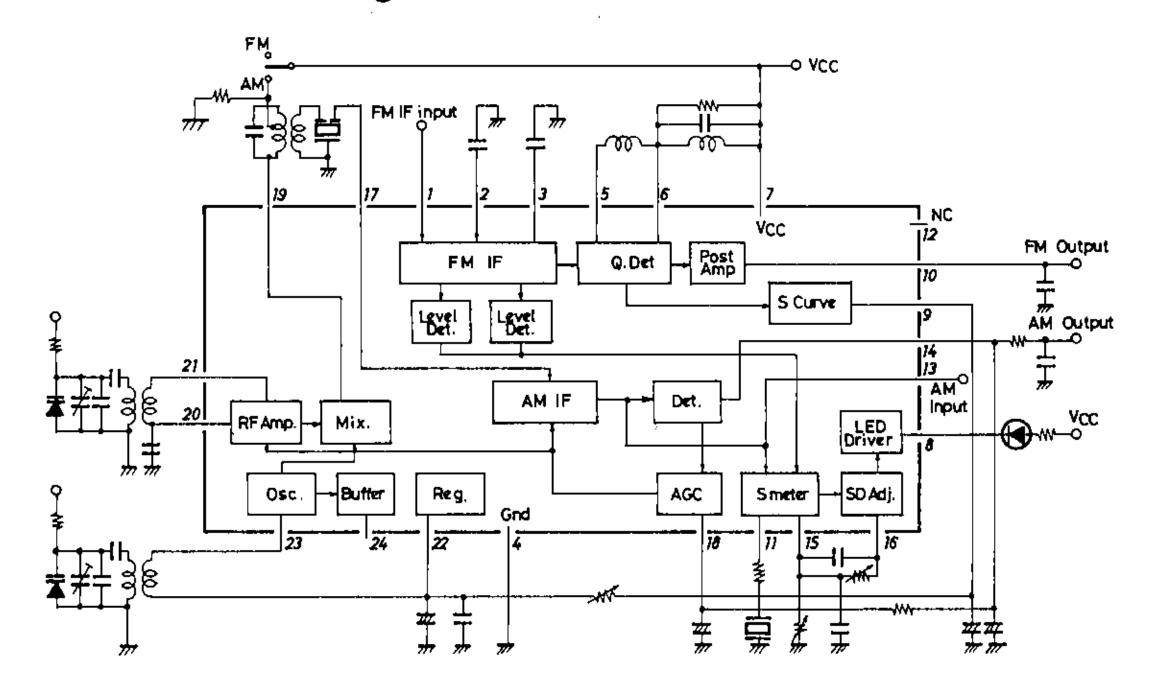
Operating Characteristics at Ta=25°C, V_{CC}=8.5V, See Test Circuit.

[AM: f=1MHz]			min	typ	max	unit
Quiescent Current	Icco	No input		18	26	mA
Detection Output	Vo(1)	Vi=20dBu,400Hz,30% mod.	30	50	90	mV
	Vo(2)	Vi=80dBu,400Hz,30% mod.	110	160	220	mV
S/N	S/N(1)	Vi=20dBu	16	20		dB
	S/N(2)	Vi=80dBu	49	54		dB
Total Harmonic Distortion	THD(1)	Vi=80dBu,400Hz,30% mod.		0.3	1.0	%
	THD(2)	Vi=107dBu,400Hz,30% mod.		0.5	2.0	%
Signal Meter Output	$V_{SM(1)}$	No input	0	0	0.2	V
	$V_{SM(2)}$	Vi=80dBu	2.4	2.8	3.1	V
LED Lighting Sensitivity	LED on	I_{LED}=1mA	15	24	33	dBu
Local OSC Buffer Output	Vosc	f_{osc}=1.45MHz	220	275	330	mV

[FM: f=10.7MHz]			min	typ	max	unit
Quiescent Current	Icco	No input		20	28	mA
Input Limiting Sensitivity	-3dBL.S	3dBdown,400Hz,100% mod.		31	37	dBu
Demodulation Output	Vo	Vi=100dBu,400Hz,100% mod.	240	330	460	mV
S/N	S/N	Vi=100dBu	78	84		dB
Total Harmonic Distortion	THD	Vi=100%dBu,400Hz,100% mod.		0.03	0.3	%
Signal Meter Output	$V_{SM(1)}$	No input	0	0	0.2	V
	$V_{SM(2)}$	Vi=100dBu	1.5	2.7	3.1	V
LED Lighting Sensitivity	LED-on	I_{LED}=1mA	35	50	65	dBu
LED Lighting Bandwidth	LED-BW	Vi=100dB, I_{LED}=1mA	90	120	160	kHz
AM Rejection	AMR	Vi=100dBu,FM=400Hz 100% mod. AM=1kHz 30% mod.	45	60		dB

Note: Be fully careful of dielectric breakdown.

Equivalent Circuit Block Diagram



How to use the LA1267

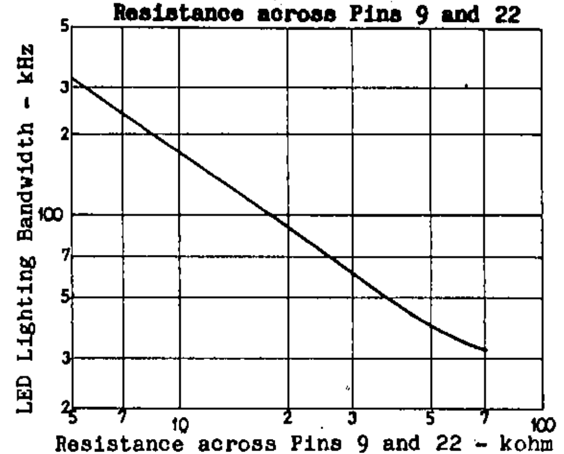
1. LED lighting, muting drive output, stop signal (S.D)

1 For LED lighting, muting drive output, stop signal, the output at pin 8 is used.

2 The voltage on pin 8, when tuned, turns from "H" to "L". (Active-Low)

3 Signal bandwidth at pin 8

- For AM, the bandwidth depends on the CF (BFU450CN) at pin 11. If a capacitor is connected in place of the CF, the bandwidth will get wider.
- For FM, the bandwidth depends on the resistance across pins 9 and 22. If the resistance is increased, the bandwidth will get narrower. R=15kohm makes the bandwidth approximately 120kHz.



4 Sensitivity adjustment of LED, muting, stop signal

- For FM, the semifixed variable resistor across pin 15 and GND is used.
- For AM, the semifixed variable resistor across pins 15 and 16 is used.

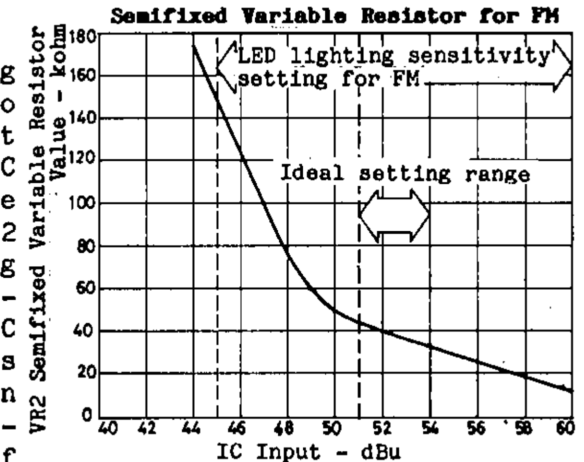
Be sure to start adjustment for FM, and then make adjustment for AM. For the stop signal sensitivity and FM stop signal bandwidth, the variations should be considered and it is recommended to use the semifixed variable resistor for adjustment.

5 LED lighting sensitivity setting for AM

For the LED lighting sensitivity setting for AM, it is desirable that the IC input be 30dBu (antenna input: approximately 50dB/m). In this case, the value of VR1 is 30kohms.

6 LED lighting sensitivity setting for FM

For the LED lighting sensitivity setting for FM, the IC input may be 45dBu to 60dBu. With the variations in the front end considered, it is ideal that the IC input in a standard receiving set be 51dBu to 54dBu. The lower value of VR2 for the LED lighting sensitivity setting is as illustrated right. Since the variations in the front end cause the IC input setting sensitivity to vary, it is recommended to use a value of VR2 at an input voltage lower than a standard setting by 6dB or greater. For example, if IC input 53dBu is taken as a standard, use VR2=100kohms at IC input 47dBu.



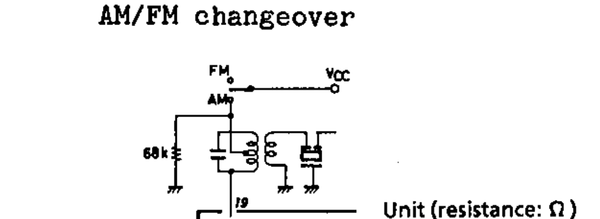
2. AM/FM changeover

1 Two selections are available for changeover as shown below: (A) pin 19-used method and (B) pin 20-used method.

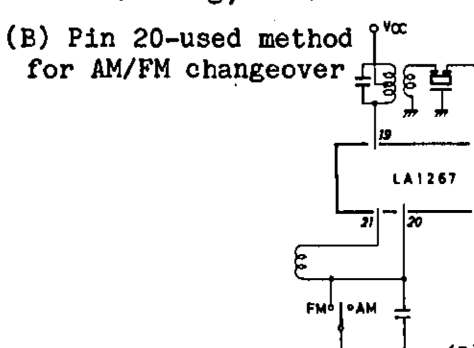
2 For (A), the voltage on pin 19 relative to V_{CC} (pin 7) must be within the range of -0.8V to +0.1V. If not within this range, distortion and selectivity will get worse.

3 For (A), a resistance of 68kohms at the IFT cold terminal, which is used to prevent the changeover circuit from malfunctioning, must be connected.

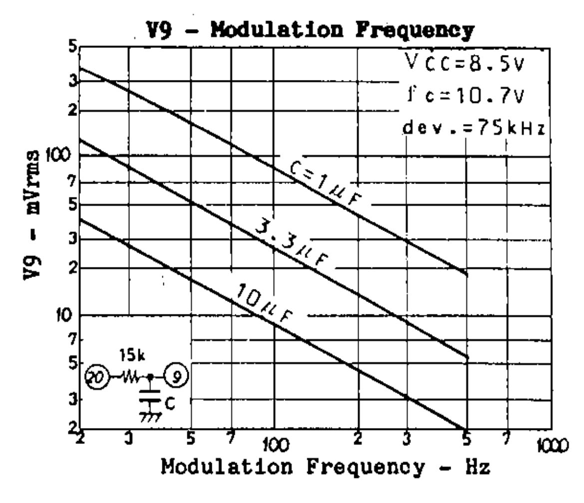
(A) Pin 19-used method for AM/FM changeover



(B) Pin 20-used method for AM/FM changeover



3. Local OSC buffer output
 1 Local OSC buffer output waveform is saw-toothed at the SW mode, connect a resistance of 1.2kohms or thereabouts across pin 24 and GND.
4. AM input pin
 1 It is desirable that the AM input pin (pin 21) be L-coupled to pin 20.
 2 Inputting to pin 21 can be done by DC-cutting with a capacitor. However, an unbalance in the RF amplifier (differential amplifier) causes gain drop and whistle worsening.
5. Capacitance across pin 9 and GND
 A large capacitance across pin 9 and GND may cause a misstop at an adjacent channel when the channel select speed is made faster at the automatic channel select mode. In this case, decrease the capacitance across pin 9 and GND. However, if too decreased, the LED will flutter at low modulation frequencies at the time of detuning. Therefore, it is recommended to fix the capacitance across pin 9 and GND to be 3.3uF to 10uF. The relation between modulation frequency and demodulation output voltage on pin 9 with the capacitance across pin 9 and GND as a parameter is shown right.



6. If the coupling coefficient of the local OSC coil is small and an anti-resonance point of approximately 100MHz is present or the stray capacitance across pins 24 and 23 is large, a parasitic oscillation of approximately 100MHz may occur in the buffer output (pin 24). In this case, connect a capacitance of approximately 30pF across pin 24 and GND.
7. AM OSC coil
 Generally speaking, the following should be noted. Avoid winding with loose coupling between primary side and secondary side (especially SW1, SW2). To put it concretely, the pot core type is better than the screw core type which is loose in coupling. This prevents the local OSC frequency from turning third resonance frequency related to the coupling coefficient.
8. Resistance across pin 8 and V_{DD}
 If pin 8 is used for the stop signal (SD) only, without using LED, it is recommended to fix resistance R_L across pin 8 and GND to be 51kohms to 100kohms.
9. To prevent whistle from worsening, make the pattern of AM output pin 14 as short as possible.

Input/Output Admittance

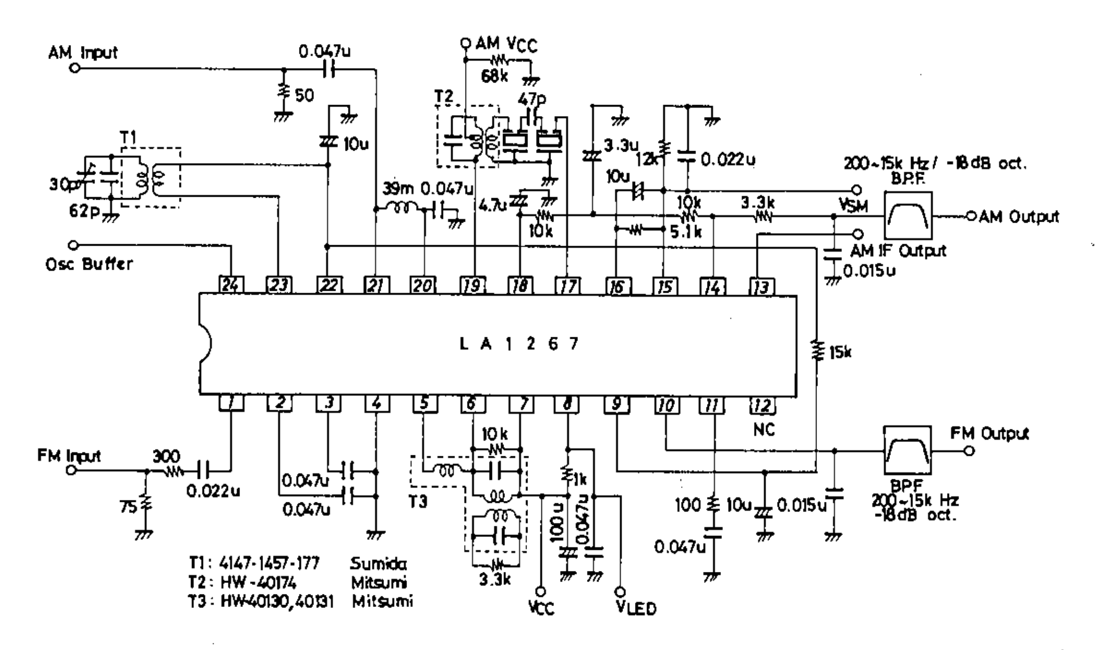
FM

-	Parameter	Frequency	-	Admittance	unit
IF	yi1	10.7MHz	ri	330	Ω
			ci	20	pF

AM

-	Parameter	Frequency	-	Admittance		unit
				AGC-off(V16=1.4V)	AGC-on(V16=2.5V)	
RF	yi21	1MHz	ri	15	16	kΩ
			ci	4	4	pF
MIX	yo19	500kHz	ro	-	-	kΩ
			co	3	3	pF
IF	yi17	500kHz	ri	2	2	kΩ
			co	10	8	pF

Test Circuit : FM, AM-MW



Unit (resistance: Ω, capacitance: F)

FM Input/Output Characteristics

Detection output 400Hz-75kHz dev.

AM output 1kHz-30%mod

Noise Voltage

f=10.7MHz

Detection Output, Noise Voltage – dBm (0, –20, –40, –60, –80, –100)

IF Input Voltage – dBu (0, 20, 40, 60, 80, 100, 120)

THD – Vi IF

f=10.7MHz

THD 400Hz-75kHz dev.

Total Harmonic Distortion, THD – % (0, 1, 2, 3, 4, 5)

IF Input Voltage – dBu (0, 20, 40, 60, 80, 100, 120)

FM Signal Meter Current Characteristic

VCC=8.5V

Non-modulation

See Test Circuit.

LED-on

Signal Meter Current, I_{SM} – mA (0, 0.1, 0.2, 0.3)

IF Input Voltage – dBu (0, 20, 40, 60, 80, 100, 120)

FM Signal Meter Voltage Characteristic

VCC=8.5V

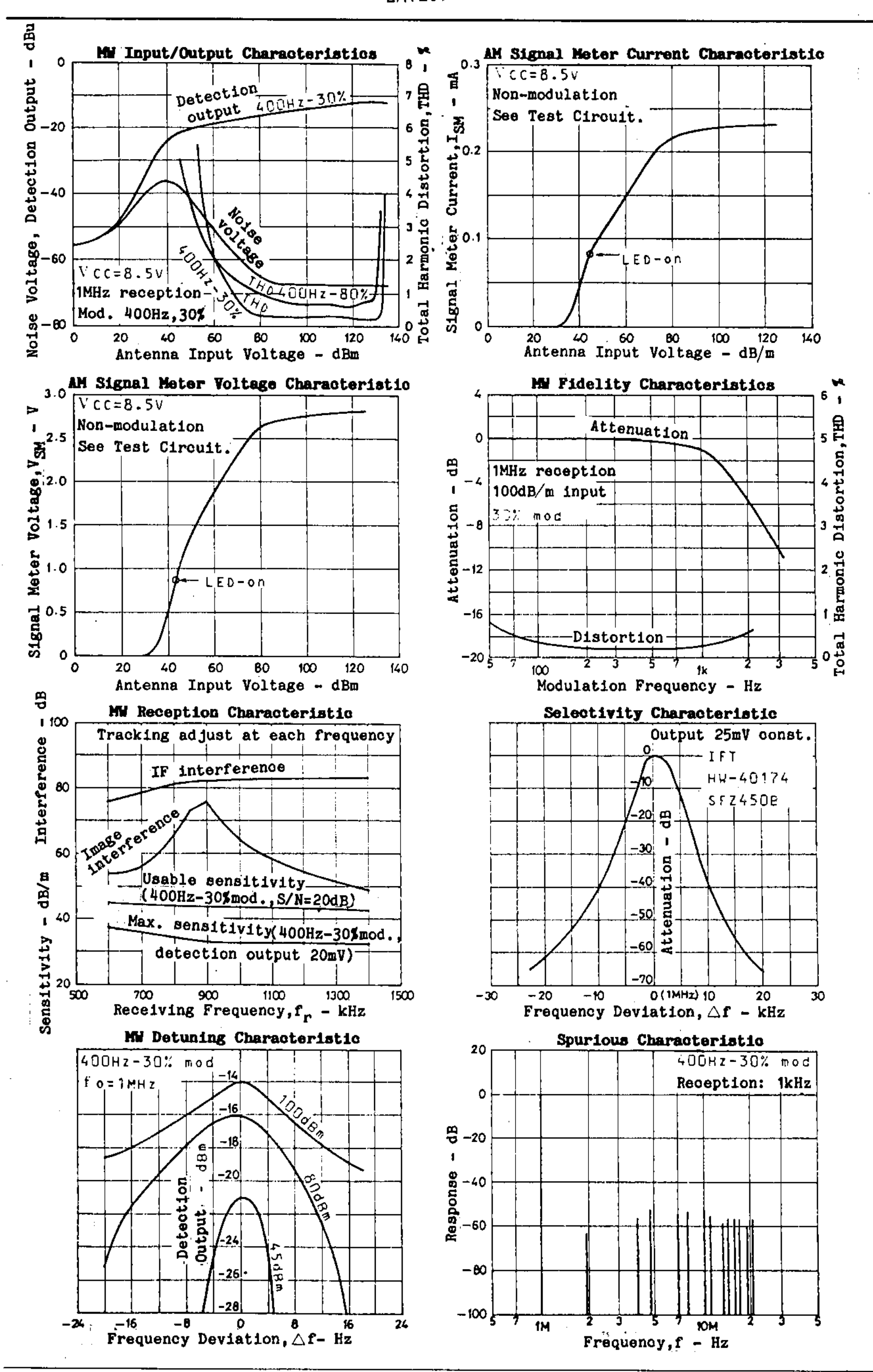
Non-modulation

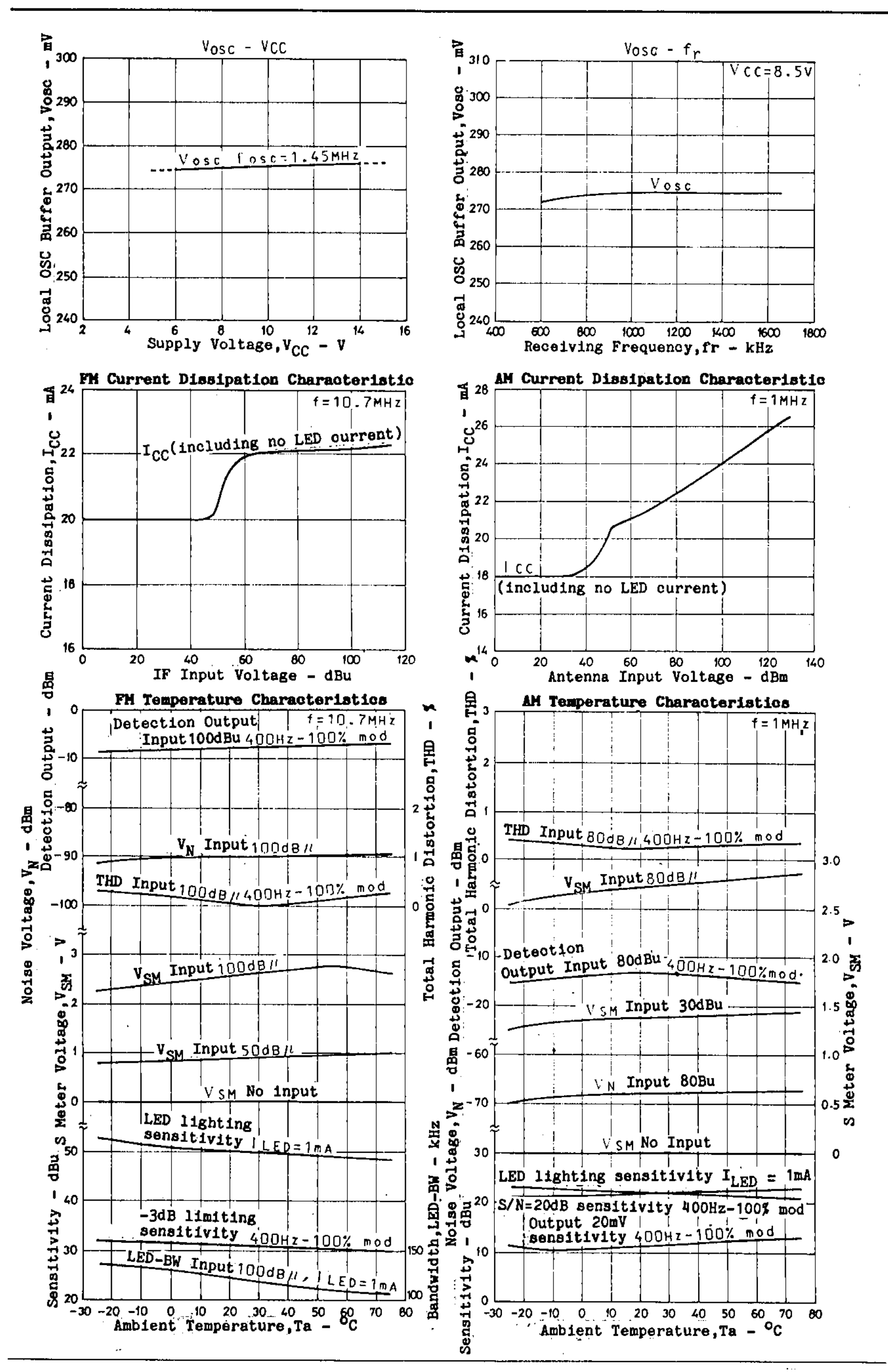
See Test Circuit.

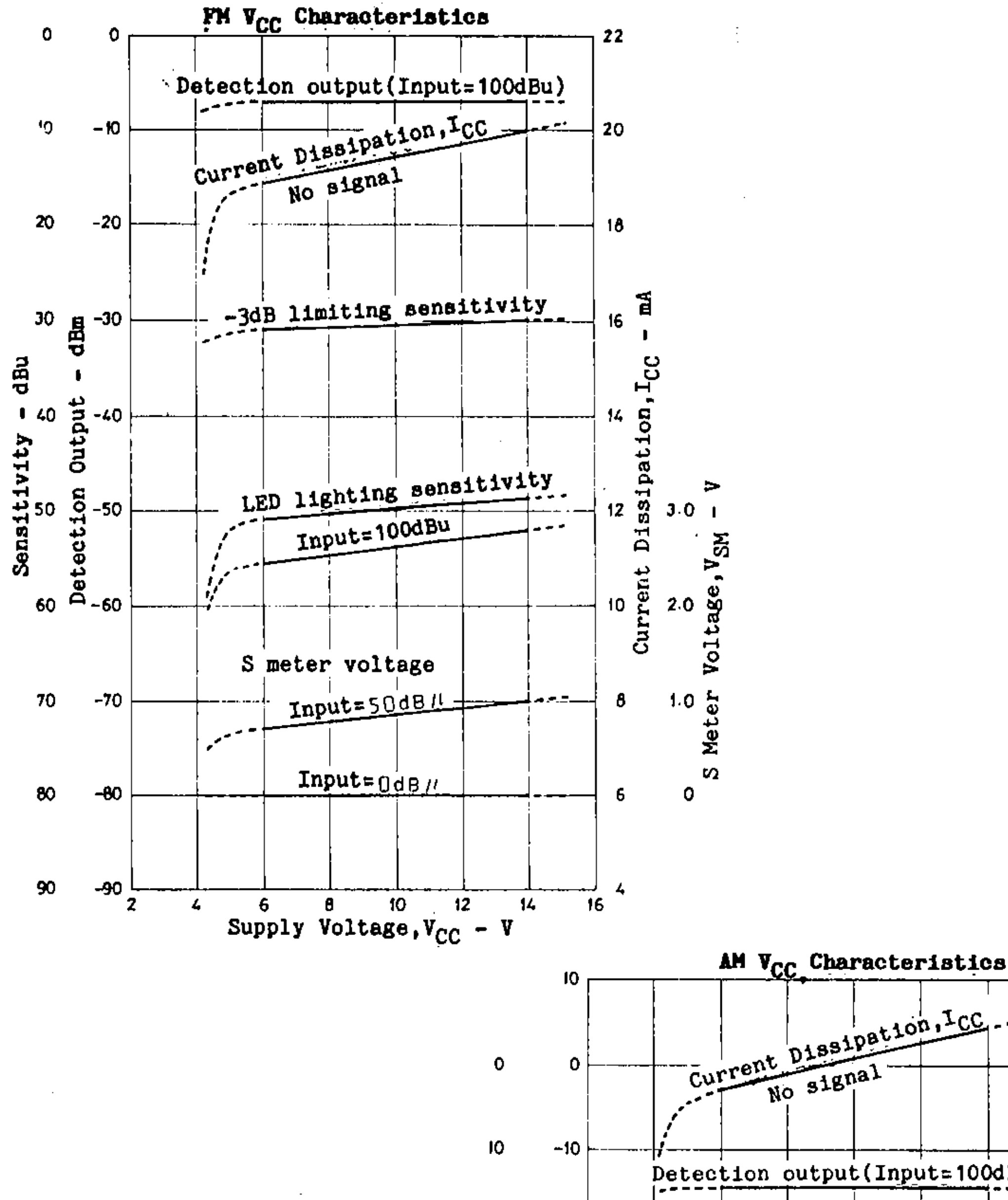
LED on

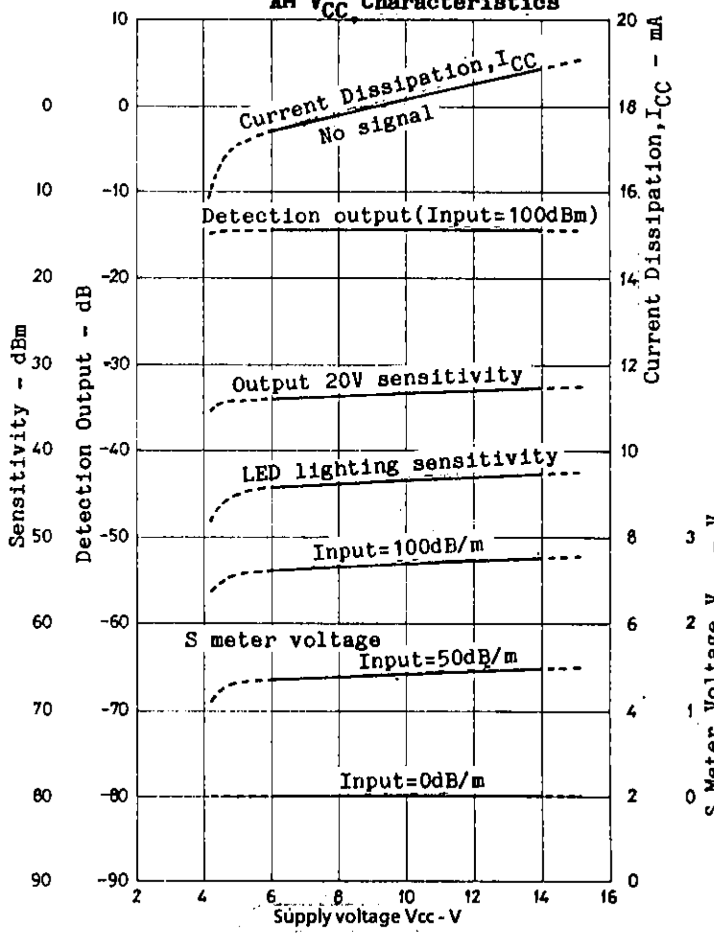
Signal Meter Voltage, V_{SM} – V (0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0)

IF Input Voltage – dBu (0, 20, 40, 60, 80, 100, 120)

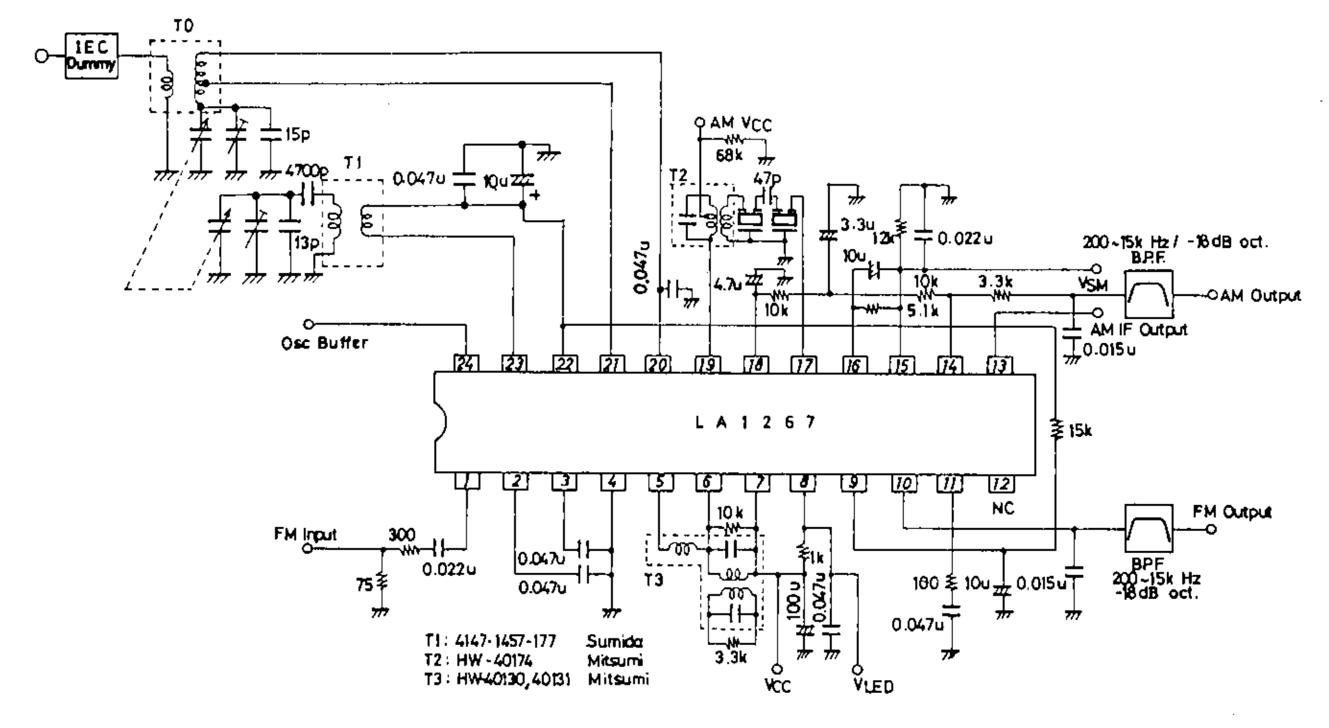

MW Input/Output Characteristics
Noise Voltage, Detection Output - dBu
Total Harmonic Distortion, THD - %
Detection output 400Hz-30%
Noise voltage
400Hz-30%
THD 400Hz-80%
THD
Vcc=8.5v
1MHz reception
Mod. 400Hz,30%
Antenna Input Voltage - dBm
AM Signal Meter Current Characteristic
Vcc=8.5v
Non-modulation
See Test Circuit.
LED-on
Signal Meter Current, I_SM - mA
Antenna Input Voltage - dB/m
AM Signal Meter Voltage Characteristic
Vcc=8.5v
Non-modulation
See Test Circuit.
LED-on
Signal Meter Voltage, V_SM - V
Antenna Input Voltage - dBm
MW Fidelity Characteristics
Attenuation
1MHz reception
100dB/m input
30% mod
Distortion
Attenuation - dB
Total Harmonic Distortion, THD - %
Modulation Frequency - Hz
MW Reception Characteristic
Tracking adjust at each frequency
IF interference
Image interference
Usable sensitivity (400Hz-30%mod., S/N=20dB)
Max. sensitivity(400Hz-30%mod., detection output 20mV)
Interference - dB
Sensitivity - dB/m
Receiving Frequency, fr - kHz
Selectivity Characteristic
Output 25mV const.
IFT
HW-40174
SFZ450B
Attenuation - dB
Frequency Deviation, Δf - kHz
MW Detuning Characteristic
400Hz-30% mod
fo=1MHz
100dBm
80dBm
45dBm
Detection Output - dBm
Frequency Deviation, Δf - Hz
Spurious Characteristic
400Hz-30% mod
Reception: 1kHz
Response - dB
Frequency, f - Hz


Vosc - VCC
Local OSC Buffer Output,Vosc - mV
Vosc fosc=1.45MHz
Supply Voltage,V_{CC} - V
Vosc - fr
VCC=8.5V
Vosc
Receiving Frequency,fr - kHz
FM Current Dissipation Characteristic
f=10.7MHz
I_{CC}(including no LED current)
Current Dissipation,I_{CC} - mA
IF Input Voltage - dBu
AM Current Dissipation Characteristic
f=1MHz
Icc
(including no LED current)
Antenna Input Voltage - dBm
FM Temperature Characteristics
Detection Output
Input 100dBu 400Hz-100% mod
f=10.7MHz
V_N Input 100dBμ
THD Input 100dBμ 400Hz-100% mod
V_{SM} Input 100dBμ
V_{SM} Input 50dBμ
V_{SM} No input
LED lighting sensitivity I_{LED}=1mA
-3dB limiting sensitivity 400Hz-100% mod
LED-BW Input 100dBμ, I_{LED}=1mA
Ambient Temperature,Ta - °C
Noise Voltage,V_N - dBm
Detection Output - dBm
S Meter Voltage,V_{SM} - V
Sensitivity - dBu
Total Harmonic Distortion,THD - %
Bandwidth,LED-BW - kHz
AM Temperature Characteristics
f=1MHz
THD Input 80dBμ 400Hz-100% mod
V_{SM} Input 80dBμ
Detection Output Input 80dBu 400Hz-100%mod
V_{SM} Input 30dBu
V_N Input 80Bu
V_{SM} No Input
LED lighting sensitivity I_{LED} = 1mA
S/N=20dB sensitivity 400Hz-100% mod
Output 20mV sensitivity 400Hz-100% mod
Ambient Temperature,Ta - °C
S Meter Voltage,V_{SM} - V


FM V_{CC} Characteristics
Detection output(Input=100dBu)
Current Dissipation, I_{CC}
No signal
-3dB limiting sensitivity
LED lighting sensitivity
Input=100dBu
S meter voltage
Input=50dBμ
Input=0dBμ
Sensitivity - dBu
Detection Output - dBm
Current Dissipation, I_{CC} - mA
S Meter Voltage, V_{SM} - V
Supply Voltage, V_{CC} - V


AM V_{CC} Characteristics
Current Dissipation, I_{CC}
No signal
Detection output(Input=100dBm)
Output 20V sensitivity
LED lighting sensitivity
Input=100dB/m
S meter voltage
Input=50dB/m
Input=0dB/m
Sensitivity - dBm
Detection Output - dB
Current Dissipation, I_{CC} - mA
S Meter Voltage, V_{SM} - V
Supply voltage Vcc - V

Test Circuit : SW2



Unit (resistance: Ω, capacitance: F)

SW2 Input/Output Characteristics (f=8.5MHz)

Detection output 400Hz-30%
Noise voltage
Detection output 400Hz-30%
Noise Voltage, Detection Output - dBm: 0, -10, -20, -30, -40, -50, -60, -70, -80
Total Harmonic Distortion, THD - %: 4, 3, 2, 1, 0
IEC Input Voltage - dBu: 0, 20, 40, 60, 80, 100, 120

SW2 Input/Output Characteristics (f=14MHz)

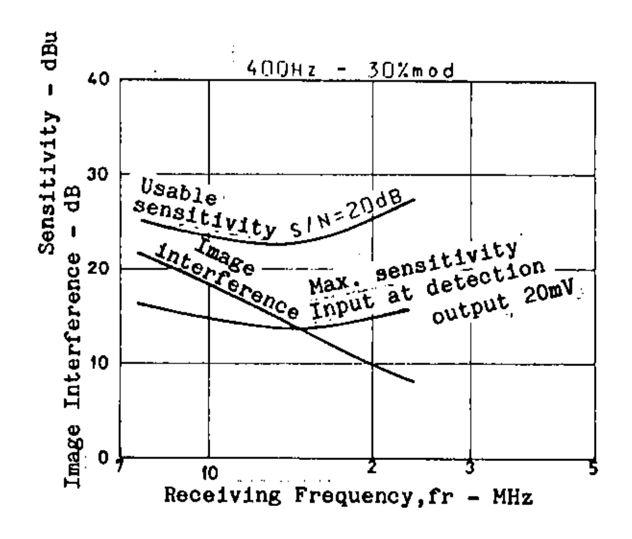
Detection output 400Hz-30%
Noise voltage
THD 400Hz-30%
Noise Voltage, Detection Output - dBm: 0, -10, -20, -30, -40, -50, -60, -70, -80
Total Harmonic Distortion, THD - %: 4, 3, 2, 1, 0
IEC Input Voltage - dBu: 0, 20, 40, 60, 80, 100, 120

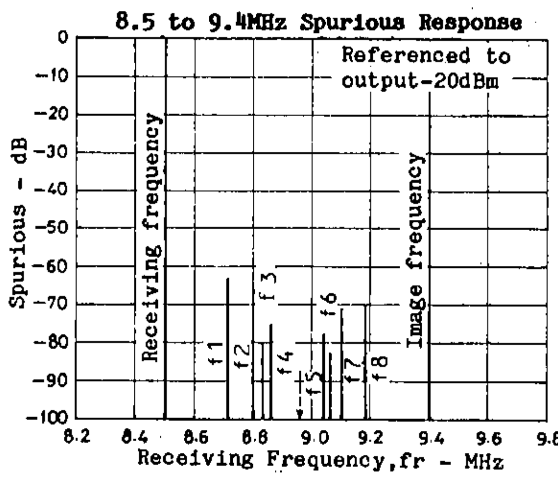
SW2 Input/Output Characteristics (f=21MHz)

Detection output 400Hz-30%
Noise voltage
THD 400Hz-30%
Noise Voltage, Detection Output - dBm: 0, -10, -20, -30, -40, -50, -60, -70, -80
Total Harmonic Distortion, THD - %: 4, 3, 2, 1, 0
IEC Input Voltage - dBu: 0, 20, 40, 60, 80, 100, 120

8.5MHz Spurious Response

Referenced to output-20dBm
Receiving frequency
Image frequency
Spurious - dB: 0, -10, -20, -30, -40, -50, -60, -70, -80, -90, -100
Frequency, f - MHz: 5, 7, 10, 2, 3





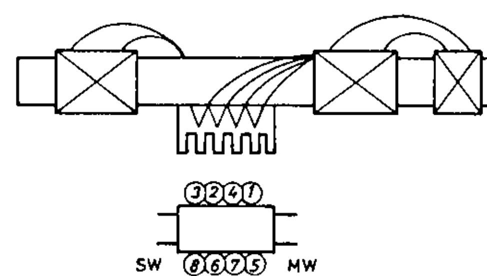
f1: 8.724MHz → 2fosc-2f1=455kHz
f2: 8.799MHz → 3fosc-3f2=455kHz
f3: 8.836MHz → 4fosc-4f3=455kHz
f4: 8.859MHz → 5fosc-5f4=455kHz
f5: 9.038MHz → 5f5-5fosc=455kHz
f6: 9.061MHz → 4f6-4fosc=455kHz
f7: 9.098MHz → 3f7-3fosc=455kHz
f8: 9.173MHz → 2f8-2fosc=455kHz

Coil Specifications

MW antenna

Bar antenna (for PVC22KTL)

・TN-10896 (Mitsumi)



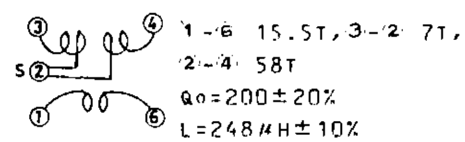
①-② 22T+49T, ③-④ 10T
Tight solenoid direct winding
⑤-⑥ 17T 0.5ϕ space winding
⑦-⑧ 4T tight solenoid winding
①-② L=260μH, Qo=330(≧200)
⑤-⑥ L=15μH, Qo=250(≧150)

Loop antenna (for SVC321)

・LA300 (Korin Giken)

・Loop antenna matching coil

・KL-412

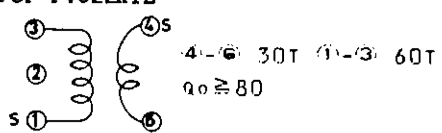


1-6 15.5T, 3-2 7T,
2-4 58T
Qo=200±20%
L=248μH±10%

MW OSC

・4147-1457-177 (Sumida)

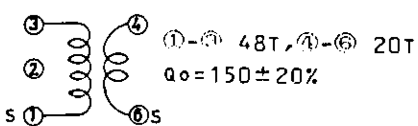
For PVC22KTL



④-⑥ 30T ①-③ 60T
Qo≧80

・KO-387 (Korin Giken)

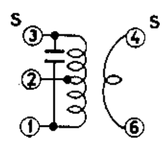
For SVC321



①-③ 48T, ④-⑥ 20T
Qo=150±20%

AM-IFT

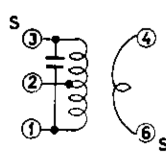
Matching coil for SFU450 (1-element type)



·HW-40173(Mitsumi)
①-② 82T, ③-② 70T,
④-⑥ 7T
Qo=110±20%, f=450kHz
Internal 180pF

2150-2162-197(Sumida)
①-② 103T, ③-② 71T,
④-⑥ 8T
Q≧80, f=450kHz
Internal 180pF

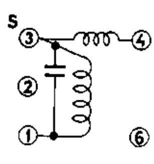
Matching coil for SFZ450 (2-element type)



·HW-40174(Mitsumi)
①-② 58T, ③-② 94T,
④-⑥ 10T
Qo=80±20%, f=450kHz
Internal 180pF

·2150-2061-049(Sumida)
①-② 54T, ③-② 120T,
④-⑥ 12T
Qo≧40
Internal 180pF

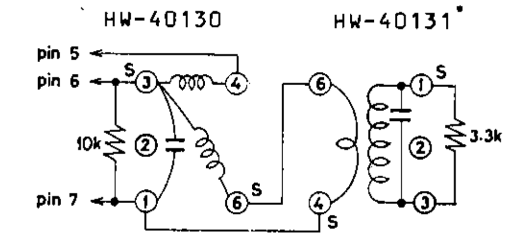
FM single tuning detection coil



·HW-40122(Mitsumi)
③-④ 84.5T, ③-① 19T
Qo=35±20%, f=10.7MHz
Internal 82pF±10%
Damping resistance

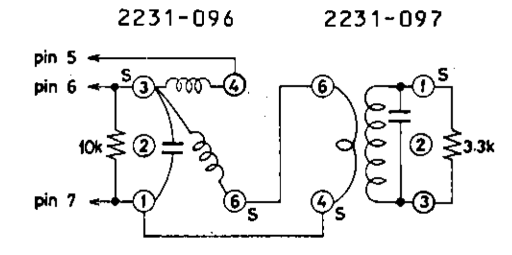
·2231-016 (Sumida)
③-④ 73.5T, ③-① 19T
Qo=30±20%, f=10.7MHz
Internal 82pF±10%
Damping resistance

FM double tuning detection coil



·HW-40130(Mitsumi)
③-④ 86.5T
③-⑥ 13.5T
Qo=50±20%
Internal 100pF±10%

·HW-40131(Mitsumi)
④-⑥ 1T
①-③ 19T
Qo=35±20%
Internal 100pF±10%

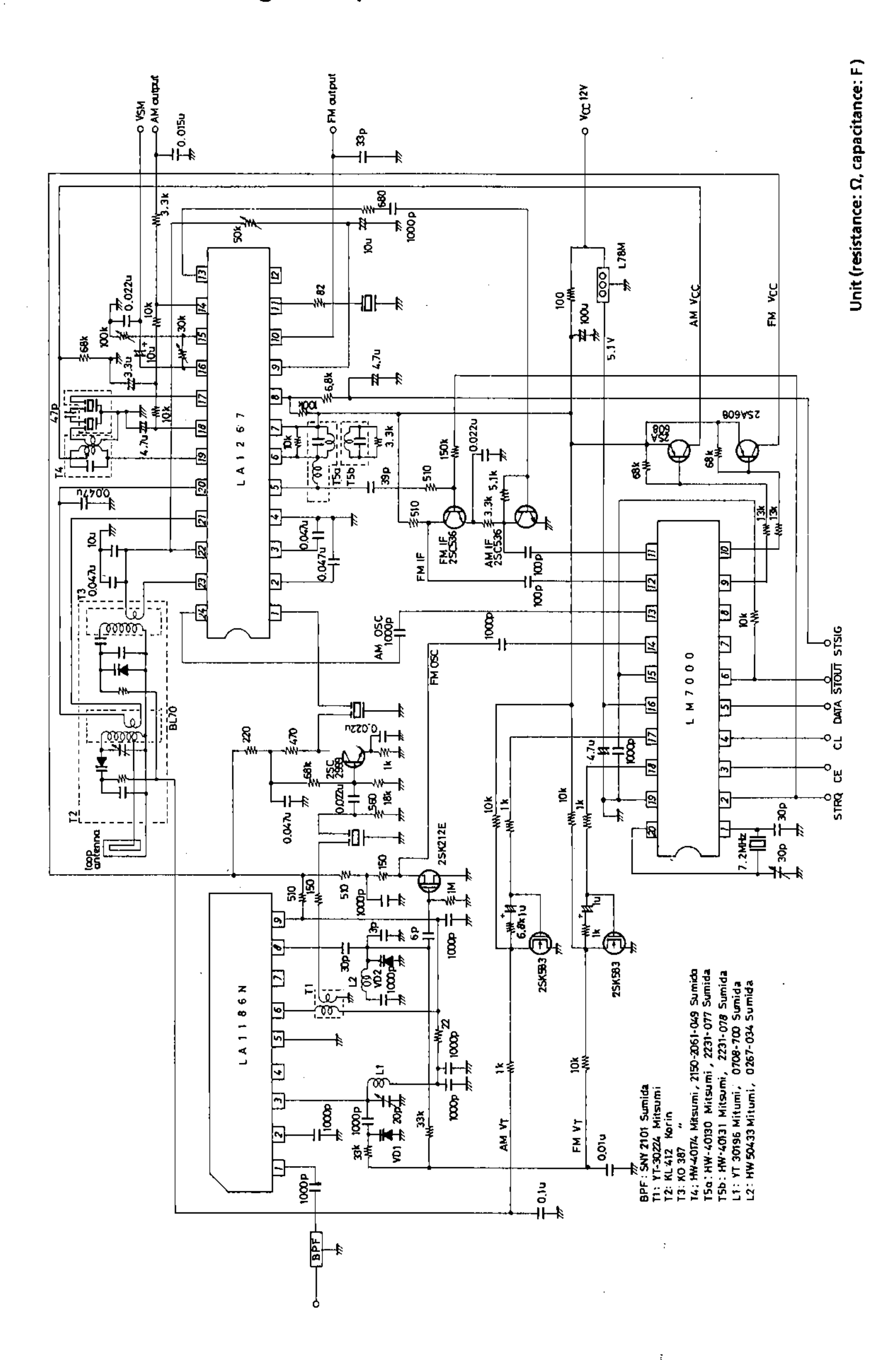


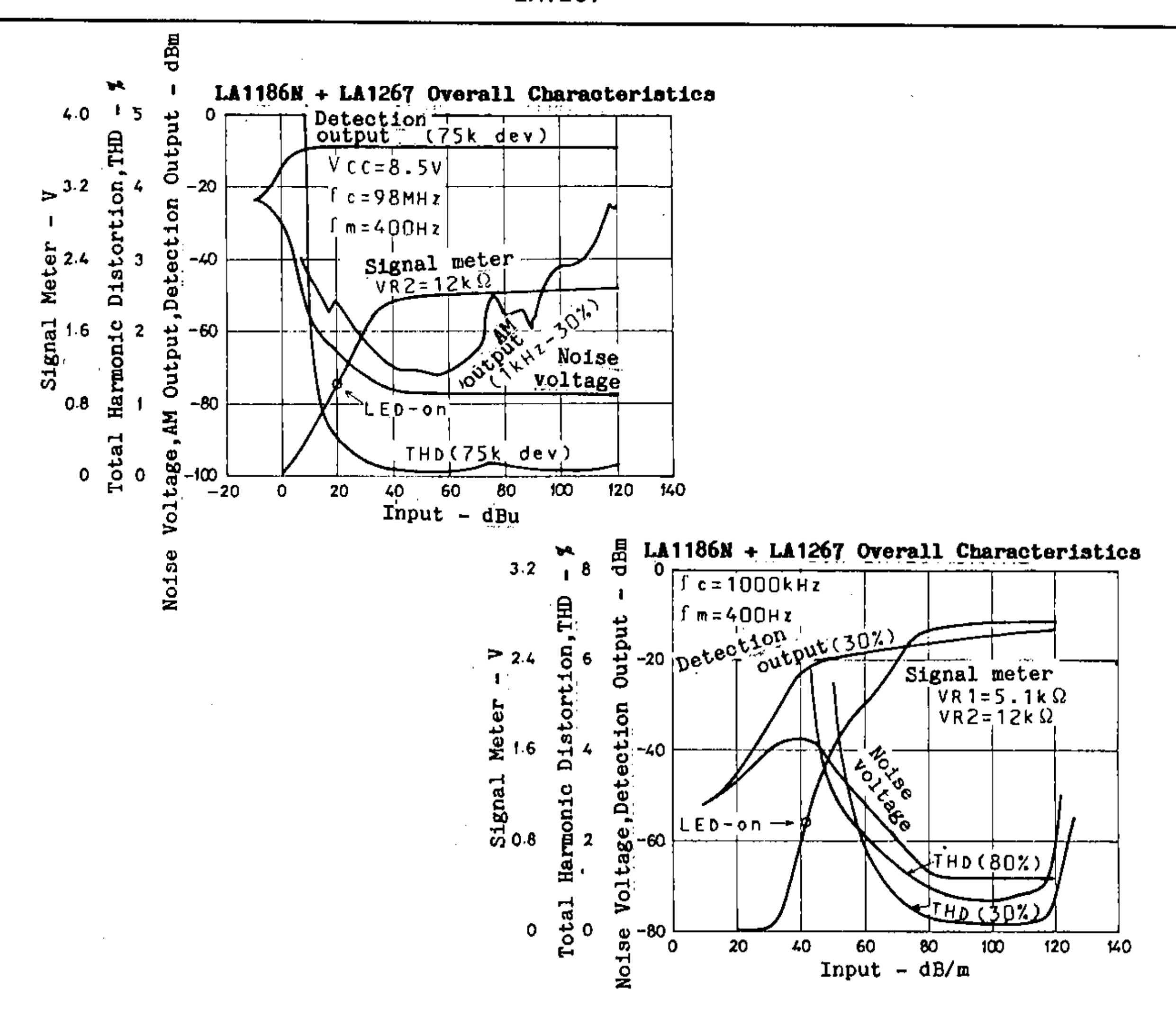
·2231-096 (Sumida)
③-④ 73.5T
③-⑥ 23.5T
Qo=50±20%
Internal 62pF±10%

·2231-097 (Sumida)
④-⑥ 2T
①-③ 21T
Qo=47±20%
Internal 82pF±10%

Unit (resistance: Ω)

Application Circuit using the LM7000




LA1186N + LA1267 Overall Characteristics
Detection output (75k dev)
Vcc=8.5V
fc=98MHz
fm=400Hz
Signal meter
VR2=12kΩ
AM output (1kHz-30%)
Noise voltage
LED-on
THD(75k dev)
Signal Meter - V
Total Harmonic Distortion,THD - %
Noise Voltage,AM Output,Detection Output - dBm
Input - dBu
LA1186N + LA1267 Overall Characteristics
fc=1000kHz
fm=400Hz
Detection output(30%)
Signal meter
VR1=5.1kΩ
VR2=12kΩ
Noise voltage
LED-on
THD(80%)
THD(30%)
Signal Meter - V
Total Harmonic Distortion,THD - %
Noise Voltage,Detection Output - dBm
Input - dB/m